Livelihoods at Risk: Agricultural Viability and Converging Climatic and Economic Change in the Central Andes

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An Andean farmer sorting freshly harvested potatoes. Photo: Benjamin Ditto.

In the world's highest tropical mountain range, the Cordillera Blanca of Peru, impacts linked to climatic change, increasing pressures on water resources, rapidly rising petroleum costs and shifting market conditions are threatening the viability of agricultural systems. Currently, these distinct processes of change are converging in ways that significantly enhance and reinforce their negative effects on the livelihood security of rural populations in this region. Based on new case study research comprised of extensive surveys and interviews with a broad range of regional stakeholders, the authors illustrate the ways in which highland farmers and their agricultural pursuits in the Cordillera Blanca are increasingly vulnerable to these intersecting changes.

Recent impacts of climate change on Andean agriculture

Historically, agricultural production in the central Andes has been characterized by a high degree of endemic risk due to the region's extreme topography, poor soil quality, climatic variability, crop pests and diseases and limited water resources (Brush and Guillet 1985). Many of these challenges are likely to be intensified by changes associated with a shifting climate regime such as increasing temperature extremes, less-predictable precipitation patterns, decreasing freshwater resources and greater prevalence of crop pests and diseases (Slingo et al. 2007). Recent research in Peru's Cordillera Blanca indicates that this intensification of threats to agricultural production is currently occurring in the region and many local residents perceive a clear link between climatic change and shifting agro-pastoral productivity (Young and Lipton 2006).

In the final decades of the twentieth century, temperatures rose markedly throughout the tropical Andes, contributing to a rapid and ongoing decline in the glaciers of the region (Bradley, Vuille et al. 2006). As tropical glaciers provide a critical source

of drinking and irrigation water for large numbers of mountain residents and downstream users, their recession has the potential to lead to significant crises over water availability. Growing water scarcity is already fomenting new social and economic conflicts over access to and use of hydrologic resources in the central Andes and will have significant impacts on agricultural productivity in the region. On the western slopes of Peru, melt water from the Cordillera Blanca is particularly important as a buffer against low precipitation and runoff levels during the tropical dry season and drought years (Mark and McKenzie 2007). Additionally, modeling of future climatic conditions in the Cordillera Blanca predicts enhanced seasonal variability by the middle of this century, with significantly less runoff occurring during the dry season (Juen et al. 2007).

People throughout the Cordillera Blanca are keenly aware of the rapid glacier recession occurring there and many case-study respondents noted decreasing water levels in the lakes, rivers and streams of the range. In relation to these changes, many of those surveyed expressed serious concern about both current and future water availability for agricultural and grazing uses. Respondents also noted that recently there have been significant shifts in water management practices such as canal improvements and extensions, irrigation rationing and a return to rain-fed agriculture in fields that have lost irrigation access due to changing water flows.

Although water scarcity is a serious concern for people of the region, our respondents were even more alarmed by recent and very marked short-term shifts in temperature extremes (colder nights and more frequent killing frosts as well as more intense solar radiation and heat) and the timing and distribution of precipitation as well as by a perceived decrease in annual rainfall. While these changes are generating a broad range of health and livelihood impacts, more frequent and severe frosts have significantly diminished high-elevation tuber crop productivity and unseasonal rainfall has damaged cereal crops close to harvest. These changes are leading to growing uncertainty about the traditional agricultural calendar, as planting and harvesting dates are shifting unpredictably in response to both unseasonal rainfall and temperature extremes.

New political economy complications

Increasingly, scholars investigating human vulnerability to global change recognise that the impacts of biophysical and socio-economic conditions and changes must be considered together to understand the ways in which their convergences increase or reduce risks and opportunities for those affected (O'Brien and Leichenko 2000). In the Cordillera Blanca, convergences of this sort are increasingly critical, as the negative impacts of climate change on highland agriculture are being significantly intensified by growing demand for water resources by downstream users, rapidly increasing petroleum prices and unfavorable market conditions for traditional Andean products.

The Rio Santa, the river with the second largest and least variable annual discharge on Peru's Pacific slope, collects the majority of the runoff from the Cordillera Blanca and supplies vital water to highland farmers. The Santa, however, also drives several hydroelectric power generating facilities along its middle reaches, provides a significant portion of the potable water used by more than a million coastal inhabitants and supplies two massive and rapidly developing coastal irrigation projects that support the growth of an estimated 100 million dollars worth of commercial agricultural products annually, most of which are exported (Painter 2007). As a significant portion of the Rio Santa's dry-season flow is made up of glacial melt water, it is likely that as glaciers recede further and discharges diminish, conflicts between these various users will ensue with more financially and politically powerful stakeholders best positioned to maintain their resource access. In addition, an important indirect effect of the recent sharp rise in global petroleum prices on Andean farmers has been a rapid increase in the costs of synthetic fertilizers and insecticides. Over the last several decades, those able to afford synthetic inputs have used them liberally to compensate for poor soil conditions and crop pests. During late 2007 and early 2008, however, farmers watched the prices for synthetic fertilisers triple and many respondents reported that they will no longer be able to afford these inputs in the quantities to which they have become accustomed, which will likely lead to significant reductions in crop yields. Prices for insecticides have also risen dramatically and demand for them has intensified due to increasing problems with both crop pests and diseases. A surprising number of respondents indicated that, given the prohibitive prices of agricultural inputs and the fact that their crops would not produce without them, planting traditional tuber and cereal crops is no longer a viable activity. Similarly, a number of respondents indicated that if input prices remained at such high levels, they would be forced to seek work in urban areas or in the region's tourism sector to support themselves.

Further exacerbating the challenges confronting Andean agricultural production are extremely low market prices for a variety of tuber crops, which provide the primary source of agricultural income for many residents of the Cordillera Blanca. Most respondents stated that they currently grow crops solely for personal consumption as market prices no longer cover even the costs of production. Research conducted several years ago in this region found similar results, reporting that many residents felt livelihoods devoted solely to agriculture were no longer sufficiently profitable to justify their pursuit (Young and Lipton 2006).

Curtailing the convergence - what can be done?

Most agricultural livelihoods in the central Andes are characterised by a high degree of risk linked to the difficult conditions of their production. Recent climate shifts, however, combined with important changes in the regional and global political economy are intensifying elements of this risk to such an extent that the viability of agricultural systems is being challenged. While an ingrained resilience born from adapting to harsh and unpredictable circumstances will undoubtedly enhance Andean agriculturalists' abilities to respond to the mounting challenges they face, the research indicates that many farmers in the Cordillera Blanca are confronting processes and impacts that they do not feel confident addressing without assistance.

This situation creates important opportunities for critical intervention from the scientific community, the Peruvian state and foreign governments and the international philanthropic and development sectors. Helping local people understand the nature and scale of the diverse changes taking place in the region and providing crucial tools to help them respond effectively to the challenges they face are key components of promoting successful adaptation (Tschakert 2007). Increasingly, it is recognised that these kinds of efforts will require new

theoretical innovations and modeling frameworks, intensive fieldwork and applied research, effective dissemination of research results, and widespread distribution of both information and material resources. To achieve these ends, Andean farmers, scientists, politicians and development practitioners will need to identify and work towards common goals through broad collaboration and a willingness to bridge significant cultural, disciplinary, and professional divides. In light of the converging threats to agricultural livelihoods in the Cordillera Blanca and the central Andes in general, this difficult work should be pursued with urgency.

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